

fx-100W
fx-115W
fx-570W
fx-991W

User's Guide

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Basic Features and Functions

CALCULATOR

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CALCULATOR

Calculator Features
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Removing and Replacing the Calculator's Cover

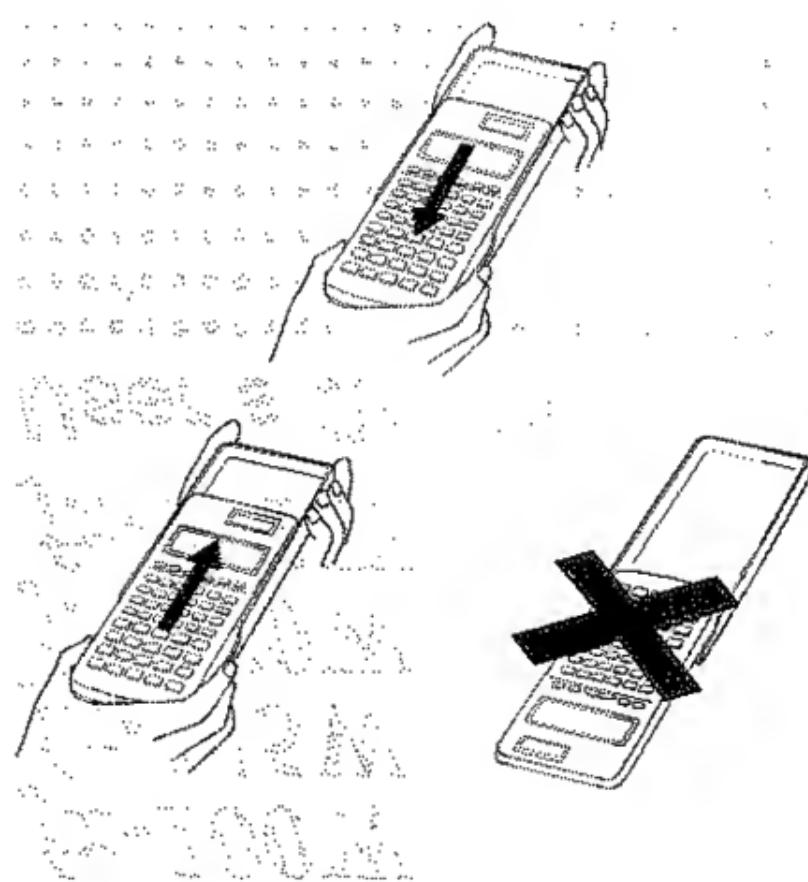
- **To Remove the cover**

Grasp the top of the cover, and slide the unit out from the bottom.

- **To Replace the cover**

Grasp the top of the cover, and slide the unit in from the bottom.

Always slide the unit into the cover with the unit's display end first. Never slide the keyboard end of the unit into the cover.



CASIO ELECTRONICS CO., LTD.
Unit 6, 1000 North Circular Road,
London NW2 7JD, U.K.

Safety Precautions

Be sure to read the following safety precautions before using this calculator. Keep this manual handy for later reference.



Caution

This symbol is used to indicate information that can result in personal injury or material damage if ignored.

Batteries

- After removing the batteries from the calculator, put them in a safe place where there is no danger of them getting into the hands of small children and accidentally swallowed.
- Keep batteries out of the reach of small children. If accidentally swallowed, consult with a physician immediately.
- Never charge batteries, try to take batteries apart, or allow batteries to become shorted. Never expose batteries to direct heat or dispose of them by incineration.
- Misuse of batteries can cause them to leak acid that can cause damage to nearby items and creates the possibility of fire and personal injury.
 - Always make sure that a battery's positive \oplus and negative \ominus sides are facing correctly when you load it into the calculator.
 - Remove the batteries if you do not plan to use the calculator for a long time.
 - Use only the type of batteries specified for this calculator in this manual.

Disposing of the Calculator

- Never dispose of the calculator by burning it. Doing so can cause certain components to suddenly burst, creating the danger of fire and personal injury.

- The displays and illustrations (such as key markings) shown in this User's Guide are for illustrative purposes only, and may differ somewhat from the actual items they represent.
- The contents of this manual are subject to change without notice.
- In no event shall CASIO Computer Co., Ltd. be liable to anyone for special, collateral, incidental, or consequential damages in connection with or arising out of the purchase or use of these materials. Moreover, CASIO Computer Co., Ltd. shall not be liable for any claim of any kind whatsoever against the use of these materials by any other party.

DISCLAIMER

• WHATEVER THE CAUSE,

• WHETHER THE CLAIM

• BASED ON CONTRACT,

Handling Precautions

- Be sure to press the **P** button on the back of the calculator (step ⑥ on page 35 or 36) before using it for the first time (fx-570W/fx-100W).
- Be sure to press the **ON** key before using the calculator for the first time (fx-991W/fx-115W).
- Even if the calculator is operating normally, replace the battery at least once every three years for the fx-570W/fx-991W/fx-115W, or at least once every two years for the fx-100W.
Dead battery can leak, causing damage to and malfunction of the calculator. Never leave the dead battery in the calculator.
- The battery that comes with the calculator when you purchase it is for testing only. It may not provide full service life.
- Low battery power can cause memory contents to become corrupted or lost completely. Always keep written records of all important data.

- **Avoid use and storage in areas subjected to temperature extremes.**

Very low temperatures can cause slow display response, total failure of the display, and shortening of battery life. Also avoid leaving the calculator in direct sunlight, near a window, near a heater or anywhere else it might become exposed to very high temperatures. Heat can cause discoloration or deformation of the calculator's case, and damage to internal circuitry.

- **Avoid use and storage in areas subjected to large amounts of humidity and dust.**

Take care never to leave the calculator where it might be splashed by water or exposed to large amounts of humidity or dust. Such elements can damage internal circuitry.

- **Never drop the calculator or otherwise subject it to strong impact.**

- **Never twist or bend the calculator.**

Avoid carrying the calculator in the pocket of your trousers or other tight-fitting clothing where it might be subjected to twisting or bending.

- **Never try to take the calculator apart.**

- **Never press the keys of the calculator with a ball-point pen or other pointed object.**

- **Use a soft, dry cloth to clean the exterior of the unit.**

If the calculator becomes very dirty, wipe it off with a cloth moistened in a weak solution of water and a mild neutral household detergent. Wring out all excess moisture before wiping the calculator. Never use thinner, benzine or other volatile agents to clean the calculator. Doing so can remove printed markings and damage the case.

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Two-line Display



5×3+2sin 60
16.13205081

You can simultaneously check the calculation formula and its answer.

The first line displays the calculation formula.

The second line displays the answer.

Key Layout

<fx-570W>

Page	12	9	REPLAY	MODE	OFF
	SHIFT	ALPHA			
Page	25	16 29 x! LOGIC	25 CONV	15 $\sqrt[3]{\cdot}$	16 $\sqrt{\cdot}$
	CALC	$\int dx$	x^3	x^3	x^3
Page	25	30	16	27	16
Page	18 24 $\leftarrow i$	12 d/c	DEC	29 HEX	15 29 10^x BIN
	ENG	$a^b c$	\checkmark	x^2	log
Page	17	12	15	16	15
Page	11 A	30 11 $\leftarrow B$	11 C	11 $\sin^{-1} D$	14 11 $\cos^{-1} E$
	(-)	$\circ, , ,$	hyp	\sin	\cos
Page	11	30	14	14	14
Page	20 DISTH	24	21 24 RCL	24 11 Abs(X)	20 11 Y
	STO	RCL	()	,
Page	11	11	11	11	11
Page	21 17 A, M	21 17 B, G	21 17 C, T	9 INS	11 19 Mc, Sel
	7	8	9	DEL	AC/ON
Page	9				
Page	21 17 י, י	21 17 י, י	21 17 י, י	19 nP	19 nP
	4	5	6	X	÷
Page	19 17 י, י	19 17 י, י	19 17 י, י	21 18 Pol(21 18 י, י Rec(
	1	2	3	+	-
Page	16 Rnd	16 Ran#	16 π	15 DRG	13 %
	0	•	EXP	Ans	=
Page	11	10			
fx-100W:	CONV	CONST	\checkmark	x^3	x^3
			15		

<fx-991W>

Page	12	9	REPLAY	2
	SHIFT	ALPHA		ON
Page	25	16 29 x/LOGIC	25 CONV	15 $\sqrt[3]{\cdot}$
	CALC	$\int dx$	$x^{\frac{1}{n}}$	x^3
Page	25	30	16	15
Page	18 24 \leftarrow	12 d/c	DEC	29 HEX
	ENG	$a\frac{b}{c}$	\checkmark	15 29 10 ¹ BIN
Page	17	12	15	15 29 e^x OCT
Page	11	30 11 \leftarrow	11 hyp	14 11 $\cos^{-1} E$
	(\rightarrow)	$\circ\circ\circ$	\sin	14 11 $\tan^{-1} F$
Page	11	30	14	14 \cos
Page	11	24	21 24 RCL	11 11 M- M
	STO	()	20 11 20- M+ 20
Page	11	11	11	11
Page	21 17 A M	21 17 B G	21 17 C T	9 INS 11 19 Mc Scl
	7	8	9	DEL AC
Page	9			
Page	21 17 F \bar{x} L μ	21 17 Y \bar{x} L μ	21 17 Y \bar{x} L μ	19 nPr 19 nCr
	4	5	6	\times \div
Page	19 17 f \bar{x} f	19 17 f \bar{x} f	19 17 f \bar{x} f	21 18 f \bar{x} f Pol 21 18 f \bar{x} f Rec
	1	2	3	+
Page	16 Rnd	16 Ran#	16 π	15 DRG 13 %
	0	*	EXP	Ans
Page	10			

fx-115W:

CONV

CONST

\rightarrow

$\sqrt[3]{\cdot}$

15

$\sqrt[3]{\cdot}$

x^3

\rightarrow

x^3

Before Starting Calculations...

■ Modes

Application	Mode Name	Mode Indicator
Calculation Modes		
Normal calculations	COMP	—
Complex number calculations	CMPLX	CMPLX
Standard deviation calculations	SD	SD
Regression calculations	REG	REG
Base-n calculations	BASE-N	b (binary) o (octal) d (decimal) H (hexadecimal)
Angle Unit Modes		
Degrees	DEG	D
Radians	RAD	R
Grads	GRA	G
Display Modes		
Exponential notation (Canceling FIX and SCI specification)	NORM1 NORM2	— —
Number of decimal place specification	FIX	Fix
Number of significant digit specification	SCI	Sci
Exponential display range specifications	ENG	ENG

Note!

- Mode indicators appear in the lower part of the display, except for the Base-n indicators which appear in the exponent part of the display.
- The ENG mode cannot be selected while the calculator is in the CMPLX or BASE-N mode.

- You cannot set the angle unit or the display mode while the calculator is in the BASE-N mode.
- The COMP, CMPLX, SD, and REG modes can be used in combination with the angle unit modes.
- Be sure to check the current calculation mode (SD, REG, COMP, CMPLX) and angle unit mode (DEG, RAD, GRA) before beginning a calculation.

Memory full

■ Input Capacity

- The memory area used for calculation input can hold 79 "steps." Whenever you input the 73rd step of any calculation, the cursor changes from "—" to "■" to let you know memory is running low. If you still need to input more, you should divide your calculation into two or more parts.

■ Making Corrections During Input

- Use **◀** and **▶** to move the cursor to the location you want.
- Press **DEL** to delete the number or function at the current cursor position.
- Press **SHIFT INS** to change to an insert cursor **[I]**. Inputting something while the insert cursor is on the display inserts the input at the insert cursor position.
- Press **◀**, **▶**, **SHIFT INS**, or **■** returns to the normal cursor from the insert cursor.

■ Replay Function

- Pressing **▶** or **◀** recalls the last calculation you performed. You can then make any changes you want in the calculation and re-execute it.
- Pressing **AC** does not clear Replay memory, so you can recall the last calculation even after you press **AC**.
- Replay memory is cleared whenever you start a new calculation, change to another mode, or turn off power.

Memory full

Memory full

Memory full

■ Error Locator

- Pressing \blacktriangleright or \blacktriangleleft after an error occurs displays the calculation with the cursor positioned at the location where the error occurred.

Example: $1234567890 \times 100 =$

■ Exponential Display Formats

This calculator can display up to 10 digits. Larger values are automatically displayed using exponential notation. In the case of decimal values, you can select between two formats that determine at what point exponential notation is used. Press MODE MODE MODE MODE [3] [1] (or [2]) to select NORM 1 or NORM 2.

• NORM 1

With NORM 1, exponential notation is automatically used for integer values with more than 10 digits and decimal values with more than two decimal places.

• NORM 2

With NORM 2, exponential notation is automatically used for integer values with more than 10 digits and decimal values with more than nine decimal places.

- All of the examples in this manual show calculation results using the NORM 1 format.

■ Answer Memory

- Whenever you press Ans after inputting values or an expression, the calculated result is automatically stored in Answer Memory. You can recall Answer Memory contents by pressing Ans .
- Answer Memory can store up to 12 digits for the mantissa and two digits for the exponent.
- Answer Memory contents are not changed if the operation performed by any of the above key operations results in an error.

Basic Calculations

- Use the COMP mode for basic calculations.

- **Example 1:** $3 \times (5 \times 10^{-9})$

3 \times (5 EXP (-) 9) = 1.5⁻⁹

- **Example 2:** $5 \times (9 + 7)$

5 \times (9 + 7) = 80.

- You can skip all () operations before =.

Memory Calculations

■ Independent Memory

- Values can be input directly into memory, added to memory, or subtracted from memory. Independent memory is convenient for calculating cumulative totals.
- Independent memory uses the same memory area as variable M.
- To clear independent memory (M), input 0 STO M.
- **Example:**

23 + 9 = 32 23 + 9 STO M 32.

53 - 6 = 47 53 - 6 M+ 47.

45 × 2 = 90 45 × 2 SHIFT M- 90.

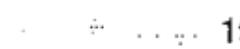
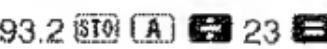
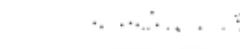
(Total) -11 45 × 2 SHIFT M- -11.

■ Variables

- There are nine variables (A through F, M, X and Y), which can be used to store data, constants, results, and other values.
- Use the following operation to delete data assigned to all nine variables: SHIFT MCL =.
- Use the following operation to delete data assigned to a particular variable: 0 STO A. This operation deletes the data assigned to variable A.

- Example: $193.2 \div 23 = 8.4$

$$193.2 \div 28 = 6.9$$

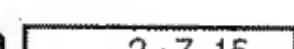
		
		

Fraction Calculations

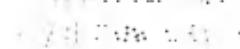
■ Fraction Calculations

- Use the COMP mode for fraction calculations.
- Values are automatically displayed in decimal format whenever the total number of digits of a fractional value (integer + numerator + denominator + separator marks) exceeds 10.

- Example 1: $\frac{2}{3} + 1\frac{4}{5}$

		
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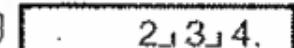
- Example 2: $\frac{1}{2} + 1.6$

		
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- Fraction/decimal calculation results are always decimal.

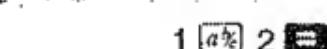
■ Decimal-to-Fraction Conversion

- Example: $2.75 \rightarrow 2\frac{3}{4}$

■ Fraction-to-Decimal Conversion

- Example: $\frac{1}{2} \leftrightarrow 0.5$ (Fraction \leftrightarrow Decimal)

		
---	---	---

0.5

1.2.

Percentage Calculations

- Use the COMP mode for percentage calculations.
- **Example 1:** To calculate 12% of 1500

1500 12 180.

- **Example 2:** To calculate what percentage of 880 is 660

660 880 75.

- **Example 3:** To add 15% onto 2500

2500 15 2875.

- **Example 4:** To discount 3500 by 25%

3500 25 2625.

- **Example 5:** If 300 grams are added to a test sample originally weighing 500 grams, what is the percentage increase in weight?

$$\frac{300 + 500}{500} \times 100 = 160 \text{ (%)}$$

300 500 160.

- **Example 6:** If temperature changes from 40°C to 46°C, what percentage did it rise?

$$\frac{46 - 40}{40} \times 100 = 15 \text{ (%)}$$

46 40 15.

Scientific Function Calculations

- Use the COMP mode for scientific function calculations.
- $\pi = 3.14159265359$

■ Trigonometric/Inverse Trigonometric Functions

- Example 1: $\sin 63^\circ 52' 41''$

MODE MODE MODE 1 → "D"
sin 63 52 41 = 0.897859012

- Example 2: $\cos\left(\frac{\pi}{3}\right)$

MODE MODE MODE 2 → "R"
cos (SHIFT π) 3 = 0.5

- Example 3: $\cos^{-1}\frac{\sqrt{2}}{2} = \frac{\pi}{4}$ rad

MODE MODE MODE 2 → "R"
SHIFT DEG (√ 2) 2 = 0.785398163
Ans = 0.25

- Example 4: $\tan^{-1} 0.741$

MODE MODE MODE 1 → "D"
SHIFT tan 0.741 = 36.53844577

■ Hyperbolic/Inverse Hyperbolic Functions

- Example 1: $\sinh 3.6$

hyp sin 3.6 = 18.28545536

- Example 2: $\sinh^{-1} 30$

hyp SHIFT sinh 30 = 4.094622224

■ Angle Unit Conversion

- Press **SHIFT DRG** to display the following menu.

D	R	G
1	2	3

- Pressing **1**, **2**, or **3** converts the displayed value to the corresponding angle unit.

- **Example :** To convert 4.25 radians to degrees

MODE MODE MODE 1 → "D"

4.25 **SHIFT DRG 2 (R)** =

4.25^r
243.5070629

■ Common and Natural Logarithms/ Antilogarithms

- **Example 1:** $\log 1.23$ **log** 1.23 = 0.089905111

- **Example 2:** $\ln 90$ (= $\log_e 90$)

ln 90 = 4.49980967

- **Example 3:** e^{10} **SHIFT e^x** 10 = 22026.46579

- **Example 4:** $10^{1.5}$ **SHIFT 10^x** 1.5 = 31.6227766

- **Example 5:** 2^4 **2 [x^y] 4** = 16.

■ Square Roots, Cube Roots, Roots, Squares, Cubes, Reciprocals, Factorials, Random Numbers and π

- **Example 1:** $\sqrt{2} + \sqrt{3} \times \sqrt{5}$

✓ 2 **+** **✓** 3 **×** **✓** 5 = 5.287196909

- **Example 2:** $\sqrt[3]{5} + \sqrt[3]{-27}$

SHIFT ✓ 5 **+** **SHIFT ✓** **(** 27 **)** = -1.290024053

(fx-100W/fx-115W: **✓**)

- Example 3: $\sqrt[3]{123}$ ($= 123^{\frac{1}{3}}$)

7 **SHIFT** **1** 123 **=** 1.988647795

- Example 4: $123 + 30^2$

123 **+** 30 **x**² **=** 1023.

- Example 5: 12^3

12 **x**³ **=** 1728.

- Example 6: $\frac{1}{3} - \frac{1}{4}$

$$\frac{1}{3} - \frac{1}{4}$$

1 **3** **x**⁻¹ **-** 4 **4** **x**⁻¹ **1** **x**⁻¹ **=** 12.

- Example 7: $8!$

8 **SHIFT** **x!** **=** 40320.

- Example 8: To generate a random number between 0.000 and 0.999

SHIFT **Rnd** **=** 0.664

Example (results differ each time)

- Example 9: 3π

3 **SHIFT** **π** **=** 9.424777961

■ FIX, SCI, RND

- Example 1: $200 \div 7 \times 14 = 400$

200 **÷** 7 **x** 14 **=** 400.

(Specifies three decimal places.)

MODE **MODE** **MODE** **MODE** **1** **3** **=** 400.000

Fix

(Calculation continues using 10 display digits)

200 **÷** 7 **=** 28.571

x 14 **=** 400.000

Performing the same calculation using the specified number of decimal places

200 **÷** 7 **=** 28.571

(Internal rounding)

SHIFT **Rnd** **=** 28.571

- Press **MODE MODE MODE MODE 3 1** to clear FIX specification.
- **Example 2:** $1 \div 3$, displaying result with two significant digits (SCI 2)

MODE MODE MODE MODE 2 2 1 = 3 = 3.3⁻⁰¹
Sci

- Press **MODE MODE MODE MODE 3 1** to clear SCI specification.

■ ENG Calculations

- **Example 1:** To convert 56,088 meters to kilometers

56088 = ENG 56.088 03

- **Example 2:** To convert 0.08125 grams to milligrams

0.08125 = ENG 81.25 03

■ Inputting ENG Calculation Symbols

- **MODE MODE MODE MODE MODE 1** enters the ENG mode in which ENG symbols can be used in calculations.
- To exit the ENG mode, press **MODE MODE MODE MODE MODE 2**.
- The following are the nine ENG symbols that can be used in ENG mode calculations.

Key Operation	Unit	Symbol
SHIFT k	10^3	k (kilo)
SHIFT M	10^6	M (Mega)
SHIFT G	10^9	G (Giga)
SHIFT T	10^{12}	T (Tera)
SHIFT m	10^{-3}	m (milli)
SHIFT μ	10^{-6}	μ (micro)
SHIFT n	10^{-9}	n (nano)
SHIFT p	10^{-12}	p (pico)
SHIFT f	10^{-15}	f (femto)

- For displayed values, the calculator selects the ENG symbol that makes the numeric part of the value fall within the range of 1 to 1000.
- ENG symbols cannot be used when inputting fractions.
- The ENG mode cannot be used in combination with the CMPLX, or BASE-N modes.
- Performing any of the key operations in the above table while you are not in the ENG mode inputs the exponential value in the "Unit" column (without inputting the ENG symbol).
- Example:** $9 \div 10 = 0.9$ m (milli)

The calculator screen shows the following sequence of operations:

MODE MODE MODE MODE MODE MODE 1

9 ÷ 10 =

0. ENG

9 ÷ 10 m
900.

In the ENG mode, even standard (non-ENG) calculation results are displayed using ENG symbols.

SHIFT ENG

0.9

END

9 ÷ 10 m
900.

■ Coordinate Conversion (Pol(x, y), Rec (r, θ))

- Calculation results are automatically assigned to variables **E** and **F**.
- Example 1:** To convert polar coordinates ($r=2$, $\theta=60^\circ$) to rectangular coordinates (x, y) (DEG mode)

The calculator screen shows the following sequence of operations:

x y

SHIFT Rec 2 60 =

1.

y

REC F

1.732050808

- RCL E**, **RCL F** swaps displayed value with value in memory.
- Example 2:** To convert rectangular coordinates $(1, \sqrt{3})$ to polar coordinates (r, θ) (RAD mode)

The calculator screen shows the following sequence of operations:

r

SHIFT Pol 1 ✓ 3 =

2.

- **Example:** To calculate σ_{n-1} , σ_n , \bar{x} , n , $\sum x$, and $\sum x^2$ for the following data : 55, 54, 51, 55, 53, 53, 54, 52

Enter SD Mode MODE MODE 1

SHIFT Sci = (Memory Clear)

55 DT	54 DT	51 DT	55 DT	53 DT	54 DT	52 DT	50	52.
(Sample Standard Deviation σ_{n-1})	SHIFT	SD-1	=	1.407885953				
(Population Standard Deviation σ_n)	SHIFT	SDn	=	1.316956719				
(Arithmetic Mean \bar{x})	SHIFT	Σx	=	53.375				
(Number of Data n)	RCL	C	=	8.				
(Sum of Values $\sum x$)	RCL	B	=	427.				
(Sum of Squares of Values $\sum x^2$)	RCL	A	=	22805.				

Data Input Precautions

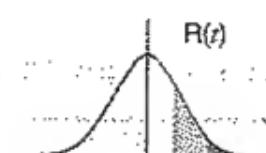
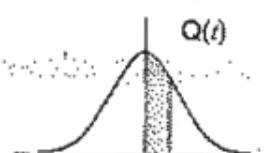
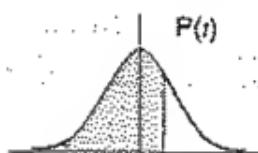
- DT DT inputs the same data twice.
- You can also input multiple entries of the same data using SHIFT ;. To input the data 110 ten times, for example, press 110 SHIFT ; 10 DT.
- The above results can be obtained in any order, and not necessarily that shown above.
- To delete data you have just input, press SHIFT CL.

■ Probability Distribution Calculations

- Press SHIFT DISTR to produce the screen shown below.

P(Q(R(→t
 1 2 3 4

- Input a value from 1 to 4 to select the probability distribution calculation you want to perform.



- Example : Using the x -data values input in the example on page 20, determine the normalized variate ($\rightarrow t$) for $x = 53$ and normal probability distribution $P(t)$.

53 **MODE** **DISTR** **4** ($\rightarrow t$) **=** -0.284747398

SHIFT **DISTR** **1** ($P()$) -0.28 **=** 0.38974

■ Regression Calculations (REG Mode)

- Press **MODE** **MODE** **2** to enter the REG mode and then select one of the following regression types:
 - 1**: Linear regression
 - 2**: Logarithmic regression
 - 3**: Exponential regression
 - ▶ 1**: Power regression
 - ▶ 2**: Inverse regression
 - ▶ 3**: Quadratic regression
- Data input always starts with **SHIFT** **Sci** **=** to clear statistical memory.
- The values produced by a regression calculation depend on the values input, and results can be recalled using the key operations shown in the table below.

RCL A	Σx^2	SHIFT X²	$x\sigma_{n-1}$
RCL B	Σx	SHIFT y	\bar{y}
RCL C	n	SHIFT y₀	$y\sigma_n$
RCL D	Σy^2	SHIFT y²	$y\sigma_{n-1}$
RCL E	Σy	SHIFT A	Regression coefficient A
RCL F	Σxy	SHIFT B	Regression coefficient B
RCL M	Σx^3	SHIFT C	Regression coefficient C
RCL X	Σx^2y	SHIFT r	Correlation coefficient r
RCL Y	Σx^4	SHIFT t	\hat{x}
SHIFT X̄	\bar{x}	SHIFT ȳ	\hat{y}
SHIFT Xσ_n	$x\sigma_n$		

• Linear Regression

The regression formula for linear regression is: $y = A + Bx$.

• **Example:** Atmospheric Pressure vs. Temperature

Temperature	Atmospheric Pressure
10°C	1003 hPa
15°C	1005 hPa
20°C	1010 hPa
25°C	1011 hPa
30°C	1014 hPa

Perform linear regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate atmospheric pressure at 18°C and temperature at 1000 hPa.

Enter REG Mode (Linear Regression)

MODE MODE 2 1

SHIFT Sci = (Memory Clear)

10 □ 1003 DT 15 □ 1005 DT
20 □ 1010 DT 25 □ 1011 DT
30 □ 1014 DT

30.

REG

(Regression Coefficient A)

SHIFT A = 997.4

(Regression Coefficient B)

SHIFT B = 0.56

(Correlation Coefficient r)

SHIFT R = 0.982607368

(Atmospheric Pressure at 18°C)

18 SHIFT F = 1007.48

(Temperature at 1000 hPa)

1000 SHIFT X = 4.642857143

• **Quadratic Regression**

- The regression formula for quadratic regression is:

$$y = A + Bx + Cx^2$$

- Input data using the following key sequence.

<x-data> □ <y-data> DT

- Example:**

x_i	y_i
29	1.6
50	23.5
74	38.0
103	46.4
118	48.0

Perform quadratic regression to determine the regression formula terms and correlation coefficient for the data nearby. Next, use the regression formula to estimate the values for \hat{y} (estimated value of y) for $x_i = 16$ and \hat{x} (estimated value of x) for $y_i = 20$.

Enter REG mode (Quadratic regression)

MODE **MODE** **2** **DT** **3**

SHIFT **Sci** **DT**

29 **DT** 1.6 **DT** 50 **DT** 23.5 **DT**
74 **DT** 38.0 **DT** 103 **DT** 46.4 **DT**
118 **DT** 48.0 **DT**

118. **REG**

(Regression Coefficient A)

SHIFT **A** **=** -35.59856934

(Regression Coefficient B)

SHIFT **B** **=** 1.495939413

(Regression Coefficient C)

SHIFT **C** **=** -6.71629667⁰³

(y when $x_1 = 16$)

16 **SHIFT** **3** -13.38291067

(\hat{x}_1 when $y_1 = 20$)

20 **SHIFT** **1** 47.14556728

(\hat{x}_2 when $y_1 = 20$)

SHIFT **2** 175.5872105

Data Input Precautions

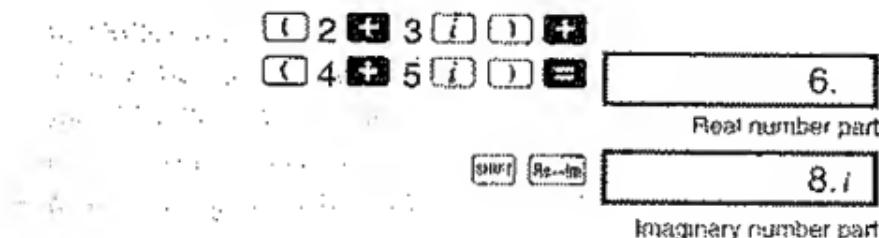
- **DT DT** inputs the same data twice.
- You can also input multiple entries of the same data using **SHIFT** **;**. To input the data "20 and 30" five times, for example, press 20 **;** 30 **SHIFT** **;** 5 **DT**.
- The above results can be obtained in any order, and not necessarily that shown above.
- To delete data you have just input, press **SHIFT** **CL**.

Complex Number Calculations (CMPLX Mode)

- Press **MODE** **2** to enter the CMPLX Mode for calculations that include complex numbers.
- You can use variables A, B, C and M only. Variables D, E, F, X, and Y are used for storage of the imaginary parts of values and so cannot be used by you.

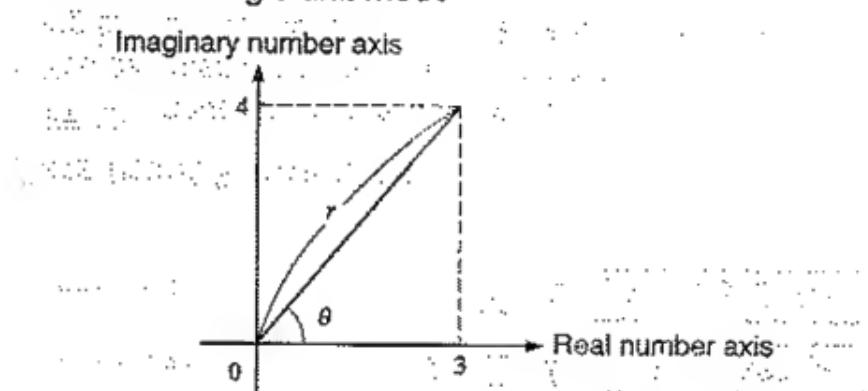
- Example: $(2 + 3i) + (4 + 5i)$

Enter CMPLX Mode MODE 2

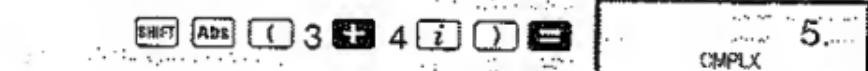


■ Absolute Value/Argument Calculation

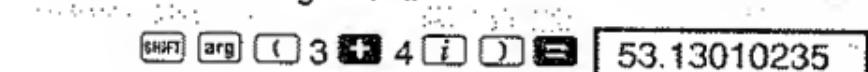
- The procedure described below can be used to determine the absolute value (Abs) and argument (arg) for a complex number of the format $Z = a + bi$, which is presumed to exist as coordinates on a Gaussian plane.
- Example: To obtain the absolute value (r) and argument (θ) for the complex number $3 + 4i$, when DEG is set for the angle unit mode



Determine the absolute value.



Determine the argument.



Formula Memory

- Formula memory lets you input a single formula in memory, and then input values for the formula's variables to calculate results.

- Memory can hold a single formula, up to 79 steps long. This function can be used in the COMP or CMPLX mode only.
- Note that the formula is actually stored in memory when you press the  key in the sequence below.
- **Example:** To save the following formula, recall it, and then use it to calculate a result: $Y = X^2 + 3X - 12$

Input the formula:

ALPHA Y ALPHA = ALPHA X x +
3 ALPHA X - 12

$$Y = X^2 + 3X - 12$$

Store it in memory.

600

0,

Input a value for its variable.

73

68

10

7.

8

76

- Formula memory is cleared whenever you start a new calculation, change to another mode, or turn off power.

Metric Conversions (fx-570W/fx-991W)

- A total of 20 different conversion pairs are built-in to provide quick and easy conversion to and from metric units.
- See the Conversion Pair Table on page 26 for a complete list of available conversion pairs.
- **Example:** To convert 31 inches to centimeters

- **Example:** To convert 31 inches to centimeters

2016

CONV

9

CONV@1

01 is the inches-to-centimeters conversion pair number.

31 in - cm

6

31 in = 6 m

78.74

• Conversion Pair Table

Based on ISO Standard (1992) data and CODATA Bulletin 63 (1986) data.

Number	Conversion Pair	Number	Conversion Pair
01	in → cm	21	oz → g
02	cm → in	22	g → oz
03	ft → m	23	lb → kg
04	m → ft	24	kg → lb
05	yd → m	25	atm → Pa
06	m → yd	26	Pa → atm
07	mile → km	27	mmHg → Pa
08	km → mile	28	Pa → mmHg
09	n mile → m	29	hp → kW
10	m → n mile	30	kW → hp
11	acre → m ²	31	kgf/cm ² → Pa
12	m ² → acre	32	Pa → kgf/cm ²
13	gal (US) → ℥	33	kgf·m → J
14	ℓ → gal (US)	34	J → kgf·m
15	gal (UK) → ℥	35	lbf/in ² → kPa
16	ℓ → gal (UK)	36	kPa → lbf/in ²
17	pc → km	37	°F → °C
18	km → pc	38	°C → °F
19	km/h → m/s	39	J → cal
20	m/s → km/h	40	cal → J

fx-570W fx-991W fx-570MS fx-991MS

fx-570MS fx-991MS

Scientific Constants (fx-570W/fx-991W)

- A total of 40 commonly-used scientific constants, such as the speed of light in a vacuum and Planck's constant are built-in for quick and easy lookup whenever you need them.
- Simply input the number that corresponds to the scientific constant you want to look up and it appears instantly on the display.
- See the Scientific Constant Table on pages 27 and 28 for a complete list of available constants.

- Example: To determine how much total energy a person weighing 65kg has ($E = mc^2$)

65	<input type="button" value="CONST"/>	CONST ...
28		CONST28
		28 is the "speed of light in vacuum" constant number.
		65Co_
		0.
	<input type="button" value="X^2"/>	65Co ² _
		0.
	<input type="button" value="="/>	65Co ²
		5.841908662

• Scientific Constant Table

Based on ISO Standard (1992) data and CODATA Bulletin 63 (1986) data.

Number	Constant Name	Symbol
01	proton mass	m_p
02	neutron mass	m_n
03	electron mass	m_e
04	muon mass	m_μ
05	Bohr radius	a_0
06	Planck's constant	h
07	nuclear magneton	μ_N
08	Bohr magneton	μ_B
09	Planck's constant, rationalized (h-bar)	\hbar
10	fine-structure constant	α
11	classical electron radius	r_e
12	electron Compton wavelength	λ_c
13	proton gyromagnetic ratio	γ_p
14	proton Compton wavelength	λ_{cp}
15	neutron Compton wavelength	λ_{cn}
16	Rydberg constant	R_∞
17	atomic mass unit	u
18	proton magnetic moment	μ_p
19	electron magnetic moment	μ_e
20	neutron magnetic moment	μ_n
21	muon magnetic moment	μ_μ
22	Faraday constant	F

Number	Constant Name	Symbol
23	elementary charge	e
24	Avogadro constant	NA
25	Boltzmann constant	k
26	molar volume of ideal gas	Vm
27	molar gas constant	R
28	speed of light in vacuum	C ₀
29	first radiation constant	C ₁
30	second radiation constant	C ₂
31	Stefan-Boltzmann constant	σ
32	permittivity of vacuum	ε ₀
33	permeability of vacuum	μ ₀
34	magnetic flux quantum	ϕ ₀
35	standard acceleration of gravity	g
36	astronomical unit	AU
37	parsec	pc
38	Celsius temperature	t
39	Newtonian constant of gravitation	G
40	standard atmosphere	atm

Base-*n* Calculations

- In addition to decimal values, calculations can be performed using binary, octal and hexadecimal values.
- You can specify the default number system to be applied to all input and displayed values, and the number system for individual values you input.
- You cannot use scientific functions in binary, octal, decimal, and hexadecimal calculations. You cannot input values that include decimal part and an exponent.
- If you input a value that includes a decimal part, the unit automatically cuts off the decimal part.
- Negative binary, octal, and hexadecimal values are produced by taking the two's complement.
- You can use the following logical operators between values in Base-*n* calculations: and (logical product), or (logical sum), xor (exclusive logical sum), xnor (exclusive logical sum negation), Not (negation), and Neg (minus).

- The following are the allowable ranges for each of the available number systems.

Binary	$1000000000 \leq x \leq 1111111111$
	$0 \leq x \leq 0111111111$
Octal	$4000000000 \leq x \leq 7777777777$
	$0 \leq x \leq 3777777777$
Decimal	$-2147483648 \leq x \leq 2147483647$
Hexadecimal	$80000000 \leq x \leq FFFFFFFF$
	$0 \leq x \leq 7FFFFFFF$

- Example 1:** To perform the following calculation and produce a binary result:

$$10111_2 + 11010_2$$

Binary mode

MODE MODE 3 BIN 0. ^b
 10111 \blacktriangleleft 11010 0. ^b
 = 110001. ^b

- Example 2:** To perform the following calculation and produce an octal result:

$$7654_8 \div 12_{10}$$

Octal mode

MODE MODE 3 OCT 0. ^o
 7654 \blacktriangleleft 12 0. ^o
 = 516. ^o

- Example 3:** To perform the following calculation and produce a hexadecimal result:

$$120_{16} \text{ or } 1101_2$$

Hexadecimal mode

MODE MODE 3 HEX 0. ^H
 120 \blacktriangleleft 2 (or)
 1101 \blacktriangleleft 3 (b) 1101 \blacktriangleleft 0. ^H
 = 12d. ^H

Technical Information

■ When you have a problem.....

If calculation results are not what you expect or if an error occurs, perform the following steps.

1. **MODE** **1** (COMP mode)
2. **MODE** **MODE** **MODE** **1** (DEG mode)
3. **MODE** **MODE** **MODE** **MODE** **3** **1** (NORM 1 mode)
4. Check the formula you are working with to confirm it is correct.
5. Enter the correct modes to perform the calculation and try again.

<fx-570W/fx-100W>

If the above steps do not correct your problem, press the **P** button (see page 35 or 36) on the back of the calculator to reset it. Pressing the **P** button deletes all data stored in calculator memory. Make sure you always keep written copies of all important data.

<fx-991W/fx-115W>

If the above steps do not correct the problem, press the **ON** key. The calculator performs a self-check operation and deletes all data stored in memory if any abnormality is detected. Make sure you always keep written copies of all important data.

■ Error Messages

The calculator is locked up while an error message is on the display. Press **AC** to clear the error, or press **◀** or **▶** to display the calculation and correct the problem. See "Error Locator" on page 10 for details.

Ma ERROR

- Cause
- Calculation result is outside the allowable calculation range.
- Attempt to perform a function calculation using a value that exceeds the allowable input range.

- Attempt to perform an illogical operation (division by zero, etc.).
- **Action**
 - Check your input values and make sure they are all within the allowable ranges. Pay special attention to values in any memory areas you are using.

Stk ERROR

- **Cause**
 - Capacity of the numeric stack or operator stack is exceeded.
- **Action**
 - Simplify the calculation. The numeric stack has 10 levels and the operator stack has 24 levels.
 - Divide your calculation into two or more separate parts.

Syn ERROR

- **Cause**
 - Attempt to perform an illegal mathematical operation.
- **Action**
 - Press \blacktriangleleft or \triangleright to display the calculation with the cursor located at the location of the error. Make necessary corrections.

Arg ERROR

- **Cause**
 - Improper use of argument
- **Action**
 - Press \blacktriangleleft or \triangleright to display the location of the cause of the error and make required corrections.

■ Order of Operations

Calculations are performed in the following order of precedence:

- ① Coordinate transformation: Pol (x, y) , Rec (r, θ)
Integrations: $\int dx$
- ② Type A functions:
 - With these functions, the value is entered and then the function key is pressed.
 $x^2, x^{-1}, x!, \text{etc.}$
- ③ Powers and roots: $x^y, \sqrt[x]{\text{ }}$

④ a^b/c

⑤ Abbreviated multiplication format in front of π , memory name, or variable name: 2π , $5A$, πA etc.

⑥ Type B functions:

With these functions, the function key is pressed and then the value is entered.

\sqrt{x} , $\sqrt[3]{x}$, \log , \ln , e^x , 10^x , \sin , \cos , \tan , \sin^{-1} , \cos^{-1} , \tan^{-1} , \sinh , \cosh , \tanh , \sinh^{-1} , \cosh^{-1} , \tanh^{-1} , $(-)$

⑦ Abbreviated multiplication format in front of Type B functions: $2\sqrt{3}$, $A\log 2$ etc.

⑧ Permutation and combination: nPr , nCr

⑨ x_1, x_2, \dots, x_n

⑩ $\pm, +, -, \times, \div, \sqrt{ }$

* Operations of the same precedence are performed from right to left. $e^x \ln \sqrt[3]{120} \rightarrow e^x \{\ln(\sqrt[3]{120})\}$

Other operations are performed from left to right.

* Operations enclosed in parentheses are performed first.

$(\sqrt{2}+3)^2$, $(2+3)^2$

■ Stacks

This calculator uses memory areas, called "stacks," to temporarily store values (numeric stack) and commands (command stack) according to their precedence during calculations. The numeric stack has 10 levels and the command stack has 24 levels. A stack error (Stk ERROR) occurs whenever you try to perform a calculation that is so complex that the capacity of a stack is exceeded.

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

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$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

$\text{Ans} \rightarrow \text{Ans} \rightarrow \text{Ans}$

■ Power Supply

The type of battery you should use depends on the model number of your calculator.

<fx-991W/fx-115W>

The TWO WAY POWER system actually has two power supplies: a solar cell and a G13 Type (LR44) button battery. Normally, calculators equipped with a solar cell alone can operate only when relatively bright light is present. The TWO WAY POWER system, however, lets you continue to use the calculator as long as there is enough light to read the display.

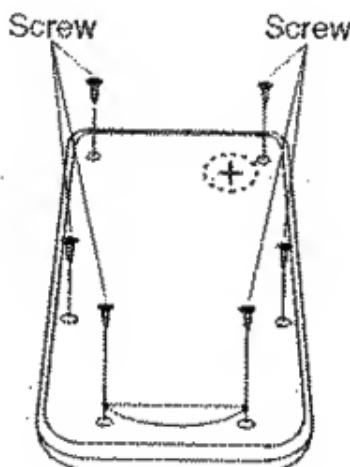
• Replacing the Battery

Either of the following symptoms indicates battery power is low, and that the battery should be replaced.

- Display figures are dim and difficult to read in areas where there is little light available.
- Nothing appears on the display when you press the **ON** key.

• To replace the battery

- ① Remove the six screws that hold the back cover in place and then remove the back cover.
- ② Remove the old battery.
- ③ Wipe off the sides of new battery with a dry, soft cloth. Load it into the unit with the positive \oplus side facing up (so you can see it).
- ④ Replace the back cover and secure it in place with the six screws.
- ⑤ Press **ON** to turn power on. Be sure not to skip this step.



This calculator is powered by single G13 Type (LR44) button battery.

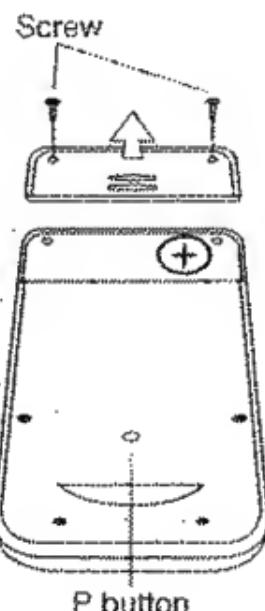
• Replacing the Battery

Dim figures on the display of the calculator indicate that battery power is low. Continued use of the calculator when the battery is low can result in improper operation. Replace the battery as soon as possible when display figures become dim.

• To replace the battery

- ① Press **OFF** to turn power off.
- ② Remove the two screws that hold the battery cover in place and then remove the battery cover.
- ③ Remove the old battery.
- ④ Wipe off the side of new battery with a dry, soft cloth. Load it into the unit with the positive **+** side facing up (so you can see it).
- ⑤ Replace the battery cover and secure it in place with the two screws.
- ⑥ Use a thin, pointed object to press the **P** button. Be sure not to skip this step.

- ⑦ Press **ON** to turn power on.



<fx-100W>

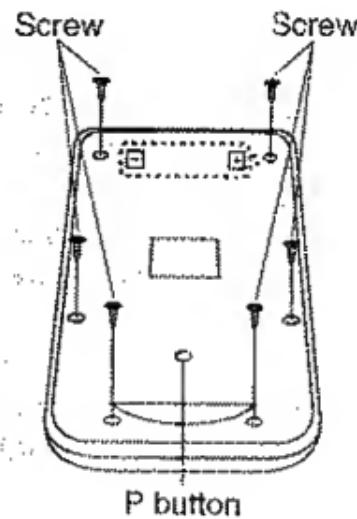
This calculator is powered by single AA-size battery.

• Replacing the Battery

Dim figures on the display of the calculator indicate that battery power is low. Continued use of the calculator when the battery is low can result in improper operation. Replace the battery as soon as possible when display figures become dim.

• To replace the battery

- ① Press **OFF** to turn power off.
- ② Remove the six screws that hold the back cover in place and then remove the back cover.
- ③ Remove the old battery.
- ④ Load a new battery into the unit so its positive \oplus and negative \ominus sides are facing correctly.
- ⑤ Replace the back cover and secure it in place with the six screws.
- ⑥ Use a thin, pointed object to press the P button. Be sure not to skip this step.
- ⑦ Press **AC** to turn power on.



• Auto Power Off

Calculator power automatically turns off if you do not perform any operation for about six minutes. When this happens, press **AC** (fx-991W/fx-115W: **ON**) to turn power back on.

■ Input Ranges

Internal digits: 12

Accuracy: As a rule, accuracy is ± 1 at the 10th digit.

Functions	Input Range	
$\sin x$	DEG	$0 \leq x \leq 4.499999999 \times 10^{10}$
	RAD	$0 \leq x \leq 785398163.3$
	GRA	$0 \leq x \leq 4.499999999 \times 10^{10}$
$\cos x$	DEG	$0 \leq x \leq 4.500000008 \times 10^{10}$
	RAD	$0 \leq x \leq 785398164.9$
	GRA	$0 \leq x \leq 5.000000009 \times 10^{10}$
$\tan x$	DEG	Same as $\sin x$, except when $ x = (2n-1) \times 90$.
	RAD	Same as $\sin x$, except when $ x = (2n-1) \times \pi/2$.
	GRA	Same as $\sin x$, except when $ x = (2n-1) \times 100$.
$\sin^{-1} x$		$0 \leq x \leq 1$
$\cos^{-1} x$		$0 \leq x \leq 1$
$\tan^{-1} x$		$0 \leq x \leq 9.999999999 \times 10^{99}$
$\sinh x$		$0 \leq x \leq 230.2585092$
$\cosh x$		$0 \leq x \leq 1$
$\sinh^{-1} x$		$0 \leq x \leq 4.999999999 \times 10^{99}$
$\cosh^{-1} x$		$0 \leq x \leq 1$
$\tanh x$		$0 \leq x \leq 9.999999999 \times 10^{-1}$
$\tanh^{-1} x$		$0 \leq x \leq 1$
$\log x/\ln x$		$0 < x$
10^x		$-9.999999999 \times 10^{99} \leq x \leq 99.99999999$
e^x		$-9.999999999 \times 10^{99} \leq x \leq 230.2585092$
\sqrt{x}		$0 \leq x \leq 1 \times 10^{100}$
x^2		$ x < 1 \times 10^{50}$
$\pm 1/x$		$ x < 1 \times 10^{100}; x \neq 0$
$\sqrt[3]{x}$		$ x < 1 \times 10^{100}$
$x!$		$0 \leq x \leq 69$ (x is an integer)

Functions	Input Range
nPr	$0 \leq n \leq 99, r \leq n$ (n, r is an integer) $1 \leq \{n!/(n-r)!\} \leq 9.999999999 \times 10^{99}$
nCr	$0 \leq n \leq 99, r \leq n$ (n, r is an integer)
$\text{Pol}(x, y)$	$ x , y \leq 9.999999999 \times 10^{99}$ $(x^2+y^2) \leq 9.999999999 \times 10^{99}$
$\text{Rec}(r, \theta)$	$0 \leq r \leq 9.999999999 \times 10^{99}$ θ : Same as $\sin x, \cos x$
$ a $	$ a , b, c < 1 \times 10^{100}$
b^c	$0 \leq b, c$
DEC to D	$ x < 1 \times 10^{100}$
$\text{DEC} \leftrightarrow \text{SEX}$	Decimal \leftrightarrow Sexagesimal Conversions $0^{\circ}0'0'' \leq x \leq 999999^{\circ}59'$
x^y	$x > 0: -1 \times 10^{100} < y \log x < 100$ $x = 0: y > 0$ $x < 0: y = n, \frac{1}{2n+1}$ (n is an integer) However: $-1 \times 10^{100} < y \log x < 100$
$x\sqrt{y}$	$y > 0: x \neq 0$ $-1 \times 10^{100} < 1/x \log y < 100$ $y = 0: x > 0$ $y < 0: x = 2n+1, \frac{1}{n}$ ($n \neq 0; n$ is an integer) However: $-1 \times 10^{100} < 1/x \log y < 100$
$a^{b/c}$	Total of integer, numerator, and denominator must be 10 digits or less (including division marks).
SD (REG)	$ x < 1 \times 10^{50}$ $ y < 1 \times 10^{50}$ $ n < 1 \times 10^{100}$ $x\sigma_n, y\sigma_n, \bar{x}, \bar{y}$ $A, B, r: n \neq 0$ $x\sigma_{n-1}, y\sigma_{n-1}: n \neq 0, 1$

* Errors are cumulative with such internal continuous calculations as x^2 , $\sqrt[n]{\cdot}$, $x!$, and $\sqrt[3]{x}$, so accuracy may be adversely affected.

Specifications

Power Supply:

fx-100W: Single AA-size battery (R6P (SUM-3))

fx-570W: Single G13 Type button battery (LR44)

fx-115W/fx-991W:

Solar cell and a single G13 Type button battery (LR44)

Battery Life:

fx-100W: Approximately 17,000 hours continuous display of flashing cursor.

Approximately 2 years when left with power turned off.

fx-570W: Approximately 12,000 hours continuous display of flashing cursor.

Approximately 3 years when left with power turned off.

fx-115W/fx-991W:

Approximately 3 years (1 hour use per day).

Dimensions:

fx-100W: 19.2(H)×76(W)×164(D) mm
3/4"(H)×3"(W)×67/16"(D)

fx-115W/fx-570W/fx-991W:
10(H)×76(W)×150(D) mm
3/8"(H)×3"(W)×57/8"(D)

Weight:

fx-100W: 114 g (4 oz) including battery

fx-115W/fx-570W/fx-991W: 85 g (3 oz) including battery

Power Consumption: 0.0001W

Operating Temperature: 0°C ~ 40°C (32°F ~ 104°F)